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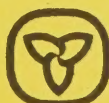
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Ministry of
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Program Resources Branch, Department of
Colleges and Universities.

The Training Specification is issued by the
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MICROWAVE OVEN REPAIR


FOREWORD

This Training Specification is issued by the Program Resources Branch, Ontario Ministry of Colleges and Universities.

The Training Consultant group under Mr. G. I. Bruce, initiated a study by selecting representatives of industry to assist in the preparation of a curriculum. This sub-committee was composed of the following representatives:

Mr. F. Carlino	Litton, Toronto
Mr. R. Luscombe	GSW Home Service, Toronto
Mr. P. Mavety	Canadian General Electric, Toronto
Mr. G. Reynolds	Microwave Canada
Mr. J. Roberts	Philips, Toronto
Mr. T. Yamamoto	Panasonic, Toronto
Mr. J. Lissack	Program Resources Branch, Ministry of Colleges and Universities, Toronto, (Chairman)

Examinations, for the purpose of supporting this program were developed by Mr. A. C. Brierley and Mr. H. Kotiesen, Examinations Development Coordinators of the Program Resources Branch. The writing of examinations is arranged, by demand, through the Industrial Training Branch.



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1. FUNDAMENTAL ELECTRICS	2. FUNDAMENTAL ELECTRONICS	3. MICROWAVE OVEN THEORY	4. POWER OUTPUT	5. OPERATING PROCEDURES	6. SAFETY ON-THE-JOB	7. TESTING PROCEDURE	8. SAFETY REGULATIONS	9. PROCEDURES	10. APPLICATION
1.01 Principles of Electricity	2.01 Solid State Devices	3.01 Magnetron Energy	4.01 Microwave Power	5.01 Operating Principles	6.01 Work Safety	7.01 Symbols	8.01 Regulatory Bodies	9.01 Repairs	10.01 Prepare and Cook Food
1.02 Ohm's Law	2.02 Rectifiers	3.02 Cavity Design	4.02 Timing Controls	5.02 Oven Cleaning	6.02 Test Instruments	7.02 Meters			
1.03 Measurement & Conversion	2.03 Rectifier Circuits	3.03 Doors & Seals	4.03 Secondary Controls	4.03 Secondary Controls	6.03 Visual Inspection	7.03 Leakage Meters			
1.04 Wire Gauges and Types	2.04 Frequency Bands	3.04 Interlock Systems	4.04 Browning Controls			7.04 Diagnostic Procedures			
1.05 Circuits									
1.06 Fuses and Breakers									
1.07 A/C and D/C									
1.08 Energy Generator									
1.09 Electrical Meters									

SPECIFIC PERFORMANCE OBJECTIVES for:			FUNDAMENTAL ELECTRICS	CCDO No.
No.	TERMINAL OBJECTIVES : to be able to ...	ENABLING OBJECTIVES : will be able to ...	TERMINAL PERFORMANCE CRITERIA : Minimum acceptable standard ...	
1.01	identify the basic electrical units	<ul style="list-style-type: none"> a) know the meaning of the words electro motive force b) know the meaning of the words electrical current c) know the meaning of the words electrical resistance d) know the basic electrical units of measurement and the symbols used to express them 	Define: a) electro motive force b) electrical current c) electrical resistance and give examples of the units of measurement of each	
1.02	relate voltage current resistance	<ul style="list-style-type: none"> a) know the meaning of OHM'S law b) know the symbols c) know the equation relevant to OHM'S law 	Express mathematically OHM'S law and demonstrate its applications.	
1.03	identify electrical units of power	<ul style="list-style-type: none"> a) know the mathematical equation for power b) know the meaning of horse power and its relationship to wattage 	Express mathematically the electrical units of power and convert them to horse power.	

SPECIFIC PERFORMANCE OBJECTIVES for:

CCDO No.

No.	TERMINAL OBJECTIVES : to be able to ...	ENABLING OBJECTIVES : will be able to ...	TERMINAL PERFORMANCE CRITERIA : Minimum acceptable standard ...
1.04	relate wire gauges and types to electrical appliance application	<ul style="list-style-type: none"> a) identify the different gauges and types of wire b) know the different materials used in the manufacture of wire and the application of each c) know the insulation required by each for safe usage 	Given specific conditions, select correct wire and insulation.
1.05	identify fundamental electric circuits using basic circuit components: <ul style="list-style-type: none"> - switches - rheostats - lamps - coils and transformers 	<ul style="list-style-type: none"> a) know what is a circuit b) know the basic types of circuits (series and parallel) c) know the safety precautions necessary in assembling a circuit d) know the use of switches and relays in circuitry 	Identify basic circuits and their components.
1.06	ascertain the function of fuses and breakers	<ul style="list-style-type: none"> a) know the reasons for the fuses and breakers b) know the different types of fuses and breakers c) understand the means by which they deactivate (open) 	Given specific conditions select correct fuse and/or breaker.

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CCDO No.

No.	TERMINAL OBJECTIVES : to be able to ...	ENABLING OBJECTIVES : will be able to ...	TERMINAL PERFORMANCE CRITERIA : Minimum acceptable standard ...
1.07	distinguish between alternating and direct current characteristics	d) understand the danger of by-passing safety features a) know the meaning of A/C and D/C and understand the principles and characteristics of each	Define the principles and characteristics of A/C and D/C current.
1.08	define the principles of the generation of electrical energy	a) know the theory of magnetism and the involvement of magnetic fields in A/C and D/C generation (including solenoid) b) know electro-magnets	Describe the theory of magnetic fields and how they generate electrical energy.
1.09	identify characteristics and applications of electrical meters: - voltmeter - ammeter - ohmmeter - multimeter - insulation tester	a) know the types and characteristics of electrical meters and their applications	Describe the characteristics and applications of electric meters.

SPECIFIC PERFORMANCE OBJECTIVES for:			FUNDAMENTAL ELECTRONICS	CCDO No.
No.	TERMINAL OBJECTIVES : to be able to ...	ENABLING OBJECTIVES : will be able to ...	TERMINAL PERFORMANCE CRITERIA : Minimum acceptable standard ...	
2.01	identify solid state devices	a) know the meaning of basic solid state b) identify the different types of semi-conductors commonly used in microwave ovens	Describe the different types of semi-conductors.	
2.02	select a rectifier	a) know the theory of rectification b) understand the use of solid state diodes and/or tubes	Demonstrate the uses of diodes and tube rectifiers.	
2.03	select rectifier circuits	a) know what is a rectifier circuit b) know the different types of rectifier circuits such as: - half wave - full wave - multiplier c) know the types of regulator circuits and their applications to: - A/C - D/C	Demonstrate the applications of rectifier circuits.	
2.04	identify the assigned frequencies	a) know the frequency spectrum b) know assigned frequencies for the use of microwave cooking	Know the frequency spectrum and assigned frequencies.	

SPECIFIC PERFORMANCE OBJECTIVES for:

MICROWAVE OVEN THEORY

CC DO No.

No.	TERMINAL OBJECTIVES : to be able to...	ENABLING OBJECTIVES : will be able to...	TERMINAL PERFORMANCE CRITERIA : Minimum acceptable standard...
3.01	select magnetrons	<ul style="list-style-type: none"> a) know basic Magnetron Theory b) identify the types of magnetrons c) know their component parts d) know the function of each part e) know the different methods of cooling f) know alternative methods of generation 	Describe types of magnetrons and identify each component and its functions.
3.02	identify the fundamentals of Cavity Design	<ul style="list-style-type: none"> a) know different feed systems b) know component parts of different feed systems c) know reasons for the dimensions of cavities d) know the different systems of energy distribution including stationary and movable reflectors, speeds, shapes and sizes e) understand the effects of alterations to manufacture designs of energy distribution 	Describe the component parts of commonly used feed systems, and the reasons for their design.

CCDO No.

SPECIFIC PERFORMANCE OBJECTIVES for:

No.	TERMINAL OBJECTIVES : to be able to ...	ENABLING OBJECTIVES : will be able to ...	TERMINAL PERFORMANCE CRITERIA : Minimum acceptable standard ...
3.03	identify doors and door seals	a) know the theory of doors and door seals including chokes b) know reasons for change of design of chokes and seals in 1970 c) know component parts and the function of each	List types of door seals in common use.
3.04	identify interlock systems including monitors	a) know the principles of interlock systems including monitors b) know the component parts of interlock systems (including monitors mandatory in 1974) c) know the interaction of each d) know the safety factors	Describe the sequence on interlock systems and the reason for their use.

SPECIFIC PERFORMANCE OBJECTIVES for:			POWER OUTPUT	CCDO No.
No.	TERMINAL OBJECTIVES : to be able to ...	ENABLING OBJECTIVES : will be able to ...	TERMINAL PERFORMANCE CRITERIA : Minimum acceptable standard ...	
4.01	test microwave power levels	<p>a) know the relationship between microwave power levels and oven use</p> <p>b) know different model microwave power levels and know how to measure them according to manufacturer's specifications</p> <p>c) know the variable power controls including single and multiple power supplied</p> <p>d) know the influence of line voltage on microwave power output</p>	Perform power level tests to manufacturer's specification.	
4.02	identify common types of timing controls	<p>a) know the operations and adjustments of mechanical dial and/or push button timer</p> <p>b) know the operation and adjustment of solid state push button dial and/or combination timers</p> <p>c) know the different types of defrost controls</p>	Select common relays and describe their functions. Describe the function of each of the common timing controls and any required adjustments.	

SPECIFIC PERFORMANCE OBJECTIVES for:

CCDO No.

No.	TERMINAL OBJECTIVES : to be able to ...	ENABLING OBJECTIVES : will be able to ...	TERMINAL PERFORMANCE CRITERIA : Minimum acceptable standard ...
4.03	identify secondary controls	a) know the function of each relay and the reasons they are required	Describe the function of secondary controls.
4.04	identify browning controls and devices	a) know the different browning controls and devices available b) know the methods of control	Name the different browning controls and devices available.

No.	TERMINAL OBJECTIVES : to be able to ...	ENABLING OBJECTIVES : will be able to ...	TERMINAL PERFORMANCE CRITERIA : Minimum acceptable standard ...
5.01	operate a microwave oven	<ul style="list-style-type: none"> a) know how to operate with load b) know consequences if no load c) know some manufacturer's compensation for no load d) know the dielectric properties of cooking aids e) know the uses and understand the limitations of metal containers and foil f) know the uses and limitations of different paper products for cooking g) know the uses and limitations of different plastic products for cooking 	<p>Operate a microwave oven with suitable load and select appropriate containers and/or utensils for use in microwave ovens. This should include each cycle of operation (cooking, browning, defrosting, etc.) supplied by the manufacturer for that model.</p>
5.02	Clean a microwave oven	<ul style="list-style-type: none"> a) know the importance of cleanliness of the cavity and door seals b) know the correct method for cleaning c) know the importance of cleanliness of diodes, leads, power supply and fans, etc. 	<p>Clean different parts of microwave oven, demonstrating the required methods and materials to be used.</p>

SPECIFIC PERFORMANCE OBJECTIVES for:

CCDO No.

No.	TERMINAL OBJECTIVES : to be able to ...	ENABLING OBJECTIVES : will be able to ...	TERMINAL PERFORMANCE CRITERIA : Minimum acceptable standard ...
		<p>d) know the importance of cleanliness of cooling system ducts, filters and exhausts</p> <p>e) know the importance of unrestricted air flow</p>	

SPECIFIC PERFORMANCE OBJECTIVES for:

No.		TERMINAL OBJECTIVES : to be able to ...	ENABLING OBJECTIVES : will be able to ...	TERMINAL PERFORMANCE CRITERIA : Minimum acceptable standard ...
6.01		work safely	<ul style="list-style-type: none">a) know the importance of disconnecting power sources, and the necessity for observance of high voltage and high current safety precautions with particular care to follow manufacturer's recommended testing proceduresb) know why and how to discharge capacitorc) know why watches, necklaces, rings, etc. should be removed before doing repairs	Describe correct sequence of operations to work safely and consequences of improper practices.
6.02		use test instruments and meter leads safely	<ul style="list-style-type: none">a) use test instruments and leads safelyb) ensure that leads used are suitable for high voltages being tested	Operate test instruments and describe how to use and maintain high voltage leads correctly.
6.03		do visual inspection	<ul style="list-style-type: none">a) recognize tamperingb) recognize physical damagec) recognize signs of arcingd) check door condition	Identify damaged or worn components.

SPECIFIC PERFORMANCE OBJECTIVES for:

CCDO No.

No.	TERMINAL OBJECTIVES : to be able to...	ENABLING OBJECTIVES : will be able to...	TERMINAL PERFORMANCE CRITERIA : Minimum acceptable standard...
		<p>e) evaluate condition of hinges and latches</p> <p>f) check for deterioration of chokes and seals</p>	

SPECIFIC PERFORMANCE OBJECTIVES for:

TESTING PROCEDURE

CCDO No.

No.	TERMINAL OBJECTIVES : to be able to ...	ENABLING OBJECTIVES : will be able to ...	TERMINAL PERFORMANCE CRITERIA : Minimum acceptable standard ...
7.01	recognize basic symbols	<ul style="list-style-type: none"> a) know symbols of components used in microwave technology b) read schematics c) read manufacturer's parts list and order the selected item correctly 	Identify any symbol used in microwave technology and be able to order any part from any manufacturer's parts list.
7.02	select and operate meters correctly	<ul style="list-style-type: none"> a) select correct meter and know how to operate each correctly b) select the correct meter scale for measurement of voltage current and resistance 	Measure various levels of voltage, current and resistance with the correct meter without damage to the instrument, appliance circuitry or components.
7.03	operate microwave survey meters	<ul style="list-style-type: none"> a) select appropriate survey meter b) operate the meter correctly c) carry out leakage testing procedure with approved water load d) know permissible leakage limits in accordance with government regulations e) operate each type of meter correctly in accordance with safety standards protecting both the operator and the instrument 	Select and operate appropriate survey meters and perform microwave leakage test.

SPECIFIC PERFORMANCE OBJECTIVES for:

CC DO No.

No.	TERMINAL OBJECTIVES : to be able to ...	ENABLING OBJECTIVES : will be able to ...	TERMINAL PERFORMANCE CRITERIA : Minimum acceptable standard ...
7.04	carry out diagnostic procedures	<ul style="list-style-type: none"> a) know safety precautions to be taken before attempting diagnostic procedure b) inspect for visual damage c) carry out diagnostic procedures as per manufacturer's specifications d) know the effect of component defect or failure as a possible cause of uneven cooking patterns 	Carry out diagnostic procedures according to manufacturer's specifications.

No.	TERMINAL OBJECTIVES : to be able to...	ENABLING OBJECTIVES : will be able to...	TERMINAL PERFORMANCE CRITERIA : Minimum acceptable standard...
8.01	apply regulations pertaining to microwave oven operation and installation	<ul style="list-style-type: none"> a) know Federal regulations and jurisdiction b) know Provincial regulations and jurisdiction c) know C.S.A. regulations and jurisdiction d) know Hydro regulations and jurisdiction e) know potential health hazards related to radio frequency leakage f) know the difference between ionizing and non-ionizing radiation 	Will identify the applicable acts and regulations for a specified repair or installation of a given type and size of microwave oven.

SPECIFIC PERFORMANCE OBJECTIVES for:

No.		TERMINAL OBJECTIVES : to be able to ...	ENABLING OBJECTIVES : will be able to ...	TERMINAL PERFORMANCE CRITERIA : Minimum acceptable standard ...
9.01	repair microwave ovens		<p>a) select correct hand tools</p> <p>b) know how to make repairs and/or adjustments as required by testing procedures according to manufacturer's specifications</p> <p>c) know how to replace defective component</p> <p>d) know the importance of part replacements according to manufacturer's specifications</p> <p>e) know which parts should be replaced as discrete components, and which parts can only be replaced as modules containing said defective part</p>	<p>Repair microwave oven having identified the source of the malfunction. Manufacturer's recommended remedy and post repair performance checks will be followed.</p>

No.	TERMINAL OBJECTIVES : to be able to...	ENABLING OBJECTIVES : will be able to ...	TERMINAL PERFORMANCE CRITERIA : Minimum acceptable standard...
10.01	know the basic principles of microwave cooking	<ul style="list-style-type: none"> a) know the theory of microwave heating b) know the reasons for defrosting the majority of frozen products prior to cooking c) know why some frozen products may not require defrosting prior to cooking d) select correct cooking utensils e) know the importance of retaining moisture during the cooking of most food items by use of development f) know food products and recipes satisfactory for microwave oven cooking g) select correct browning method 	Describe the basic principles of microwave cooking.

